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IMPROVEMENTS IN ROLLING ELEMENTS BEARINGS

TECHNICAL FIELD

The present invention relates to rolling element bearings and, more particularly, the invention relates to improvements in the performance of such bearings by treatment of the individual bearing components subjected to rolling contact during use i.e. the inner ring, outer ring and rolling elements.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a method of treatment of such rolling element bearing components to improve the properties of the component. It is also an object of the present invention to improve the performance of bearings generally.

According to an aspect of the invention there is provided a method of treatment of a rolling element bearing component by hard particle abrasion of the component, the hard particle abrasion comprising the steps of:

immersing the bearing component in a receptacle containing hard particles; and

agitating the bearing component and/or hard particles to produce relative movement therebetween and to improve the surface topography of the component.

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According to another aspect of the invention there is provided a rolling element bearing component treated in accordance with the method of the invention.

According to a further aspect of the invention there is provided a rolling element bearing comprising such a component or components.

BACKGROUND

The process of hard particle abrasion, or ceramic abrasion, is known in the art and hard particle abrasion equipment is commercially available.

DESCRIPTION

Hard particle abrasion of rolling element bearing components may simply involve immersing one or more of the bearing components in the receptacle containing the hard particles and usually a fluid carrier. The particles are typically alumina or other ceramics and can vary in size from a few microns to over a millimetre. The hardness of the particles is normally equal to or greater than that of the bearing component to be treated and the fluid is usually water. Corrosion inhibitors may be added to the fluid.

The or each bearing component and/or the hard particles in the fluid are agitated to give relative movement between the bearing components and the particles. The resulting

impact or action of the hard particles on the surface of the bearing component primarily modifies the topography of the surface, giving an improved surface finish, and preferably induces beneficial residual compressive stress in the surface. The modified surface topography has better tribological properties and the residual stress offsets the stresses experienced by the bearing component during use. Preferably, the surface finish of the component is improved to below 0.10 μm, preferably to around 0.07 μm. A pre-treatment surface finish of around 0.13 μm could be typical.

The process of hard particle abrasion when applied to bearing components alleviates surface defects that can be introduced into the component surface, for instance the raceway surface, by conventional grinding and honing. In addition, consistently good surface finishes can be achieved, preferably without the need for expensive finish grinding and honing.

DETAILED DESCRIPTION OF PREFERRED IMPLEMENTATIONS

In practice several components are treated at once.

In an example of performing the method of the present invention, bearing components are treated for around 30 minutes. The components are supported in a bath containing water with a corrosion inhibitor and alumina particles of size 10 microns. Relative

movement between the bearing components and alumina particles is provided by rotating the components in one direction while the bath is rotated in the opposite direction.

A range of alumina particle sizes may be used and an alternative example uses a typical particle size of 1 mm. Generally, the components are treated for between 10 minutes to 1 hour although 30 minutes is typical. Generally, the speed of rotation of the bath is between 30 rpm and 90 rpm, typically 60 rpm and the speed of rotation of the component is between 5 rpm and 15 rpm, typically 10 rpm.

An assessment before and after such abrasion of bearing inner rings made in M50 NiL material shows that the surface finish (Ra) is improved from around 0.1282 to 0.0715 µm. The roundness of the rings was not significantly affected and the material removed per surface was about 4 µm. The raceway of the ring required little or no further grinding or honing.

Polymet testing of ceramically abraded bearing components made in M50 NiL material gave an improvement in fatigue life of over 12 times that of untreated components.

Measurement of the residual compressive stress in the surface of M50 NiL bearing components shows that ceramic abrasion increases the compressive stress in the surface of the components by several hundred MPa. The increase in residual compressive stress

produced in the surface of a component treated in accordance with the method of the invention is between 200 MPa and 500 MPa, typically 400 MPa.

The improved surface topography and the residual compressive stress induced in the surface of the bearing components improve the fatigue resistance of the bearing components and consequently the bearing itself. In particular rolling contact fatigue performance is improved.

Rolling element bearings comprising components that have been treated in accordance with the invention may be used where an improvement in bearing performance is required. Particular examples are gas turbine engine main shaft bearings for use in aerospace or other applications.

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